

## Claims

1. A vertical heat treatment system for carrying an object to be treated, which is housed in a treating-object housing box closed by an opening/closing lid, in a treating-object transfer area via an opening, which is formed in a partition wall separating a housing-box transfer area for transferring the treating-object housing box from the treating-object transfer area in an atmosphere of an inert gas, to carry out a predetermined treatment,

wherein standby box transfer means is provided in said housing-box transfer area for holding a treating-object housing box, which houses therein the next object to be carried in said treating-object transfer area, in the vicinity of said opening to cause said treating-object housing box to stand by.

2. A vertical heat treatment system as set forth in claim 1, wherein in said housing-box transfer area, there is provided a stocker portion for temporarily storing therein said treating-object housing box, and a box transfer arm for transferring said treating-object housing box in said stocker portion to a mounting table which is provided in said opening.

3. A vertical heat treatment system as set forth in claim 1, wherein an opening/closing door is provided in said opening, and an opening/closing mechanism for removing said opening/closing door and said opening/closing lid to cause said opening/closing door and said opening/closing lid to take shelter is provided in said treating-object transfer area.

4. A vertical heat treatment system comprising:

a lifting mechanism which is vertically moved for carrying a holder, in which an object to be treated is held, in and out of a heat treatment furnace;

a holder mounting portion for mounting thereon the holder to transfer the object;

a holder transfer mechanism for transferring the holder

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between the lifting mechanism and the holder mounting portion;  
and

a treating-object transfer mechanism for transferring the object to the holder which is supported on the holder transferring portion, the treating-object transfer mechanism having a motion space region which overlaps with a motion space region of the holder transfer mechanism,

wherein said treating-object transfer mechanism comprises a swivel arm supported so as to be rotatable about a vertically extending rotation center shaft, and a transfer head provided on the tip portion of the swivel arm so as to be rotatable on a horizontal plane, and further comprises driving means having the sheltering function of moving the transfer head of the treating-object transfer mechanism on the horizontal plane along the outer peripheral edge of the lifting mechanism, which is positioned at a lower position, to cause the transfer head to take shelter on a side face portion of a housing.

5. A vertical heat treatment system as set forth in claim 4, wherein the sheltering function of the driving means of the treating-object transfer mechanism causes the transfer head of the treating-object transfer mechanism to revolve around the rotation center shaft of the swivel arm while causing the transfer head itself to rotate on its axis in the opposite direction to the direction of rotation of the transfer head, to cause the transfer head to take shelter on the side face portion in the housing.

6. A vertical heat treatment system as set forth in claim 4, wherein the sheltering function of the driving means of the treating-object transfer mechanism operates the transfer head of the treating-object transfer mechanism from a state that the transfer head is positioned at a reference position in its motion space region.

7. A vertical heat treatment system as set forth in claim 4, wherein the driving means of the treating-object transfer

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mechanism comprises a stretching mechanism for rotating the swivel arm, and a belt transmission mechanism for transmitting the rotational motion of the swivel arm to the transfer head.

8. A vertical heat treatment system as set forth in claim 4, wherein the reference position in the motion space region is set by a pulley ratio in the belt transmission mechanism.

9. A method for controlling a vertical heat treatment system comprising: a lifting mechanism which is vertically moved for carrying a holder, in which an object to be treated is held, in and out of a heat treatment furnace; a holder mounting portion for mounting thereon the holder to transfer the object; a holder transfer mechanism for transferring the holder between the lifting mechanism and the holder mounting portion; and a treating-object transfer mechanism for transferring the object to the holder which is supported on the holder transferring portion, the treating-object transfer mechanism having a motion space region which overlaps with a motion space region of the holder transfer mechanism, the treating-object transfer mechanism comprising a swivel arm supported so as to be rotatable about a vertically extending rotation center shaft, and a transfer head provided on the tip portion of the swivel arm so as to be rotatable on a horizontal plane,

wherein the transfer head of the treating-object transfer mechanism is moved on the horizontal plane along the outer peripheral edge of the lifting mechanism, which is positioned at a lower position, to take shelter on a side face portion of a housing, when the holder transfer mechanism is operated.

10. A method for controlling a vertical heat treatment system as set forth in claim 9, wherein the transfer head of the treating-object transfer mechanism is caused to revolve around the rotation center shaft of the swivel arm while the transfer head itself is caused to rotate on its axis in the opposite direction to the direction of rotation of the transfer head, to take shelter on the side face portion in the housing.

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11. A vertical heat treatment system having a holder supporting mechanism comprising:

a holder mounting table for mounting thereon a holder for holding a plurality of objects to be heat-treated, in a stacked state; and

a holder position adjusting mechanism including a plurality of protruding portions corresponding to the shape of a bottom plate of the holder, and a distance varying mechanism for varying the distance between the plurality of protruding portions.

12. A vertical heat treatment system as set forth in claim 11, wherein said holder supporting mechanism further comprises a sliding mechanism for allowing said holder mounting table to move on a plane along a holder mounting surface of said holder mounting table.

13. A vertical heat treatment system as set forth in claim 11, wherein said holder supporting mechanism further comprises a returning mechanism for returning said holder mounting table to a predetermined position, said returning mechanism including biasing means for biasing said holder mounting table in a different direction on a plane along a holder mounting surface of said holder mounting table.

14. A method for transferring an object to be treated, said method comprising:

a mounting step of causing a holder, which serves to hold a plurality of objects to be heat-treated in a stacked state, to be mounted on a holder mounting table;

a positioning step of moving said holder, which is mounted on said holder mounting table at said mounting step, together with said holder mounting table, on a plane along a holder mounting surface of said holder mounting table to position said holder at a predetermined position;

a transfer step of transferring said objects to said holder

a returning step of removing said holder, to which said objects are transferred at said transfer step, from said holder mounting table to return said holder mounting table to a predetermined position.

15. A heat treatment system comprising:

a heat treatment furnace for heat-treating an object to be treated;

a throat which is provided in said heat treatment furnace for carrying said object in and out; and

a cooling mechanism for cooling the vicinity of said throat.

16. A heat treatment system as set forth in claim 15, wherein said cooling mechanism comprises a ventilating unit having a ventilating port for sending a cooling fluid toward the vicinity of said throat, and a heat exchanger arranged so as to face said ventilating port in the vicinity of said throat.

17. A heat treatment system as set forth in claim 16, wherein said cooling mechanism further comprises an intake fan for sucking the cooling fluid in the vicinity of said throat over said heat exchanger.

18. A heat treatment system as set forth in claim 17, wherein said cooling mechanism further comprises:

a duct for forming a circulating path for said cooling fluid between said intake fan and said ventilating unit so that said cooling fluid sucked by said intake fan returns to said ventilating unit;

a filter, provided in said duct or said ventilating unit, for purifying said cooling fluid which is sent by said ventilating unit; and

an intake port which is formed on said duct at least upstream of said filter so that said cooling fluid sent by said ventilating unit is sucked at a different position from a position

at which said cooling fluid is sucked by said intake fan.

19. A heat treatment system as set forth in claim 18, wherein said cooling mechanism further comprises a second heat exchanger which is arranged in said duct between said intake port and said filter so as to cool the cooling fluid which is drawn into said duct from said intake fan and said intake port to join.

20. A heat treatment system having a loading chamber in which a mechanism for carrying an object to be treated in and out of a throat of a bottom portion of a heat treatment furnace and which has a loading chamber separated as an airtight region,

wherein said throat of said bottom portion of said heat treatment furnace is arranged above said loading chamber,

said loading chamber including:

a ventilating unit which has a ventilating port in the vicinity of said throat and a filter for purifying and sending a cooling fluid from the ventilating port to the vicinity of said throat from the side;

a first heat exchanger which is arranged so as to face said ventilating port in the vicinity of said throat;

an intake fan for sucking the cooling fluid in the vicinity of said throat over said first heat exchanger;

a circulating duct which forms a circulating path for said cooling fluid between said intake fan and said ventilating unit so that said cooling fluid sucked by said intake fan returns to said ventilating unit, at least a part of said circulating duct being arranged below said loading chamber;

an intake port which is formed in the part of said circulating duct below said loading chamber so that a part of said cooling fluid sent by said ventilating unit is sucked below said loading chamber; and

a second heat exchanger which is arranged in said circulating duct between said intake port and said filter so that the cooling fluid drawn into said circulating duct from said intake fan and said intake port to join is cooled.

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21. A method for cooling a loading chamber which is provided with a mechanism for carrying an object to be treated in or out of a throat of a heat treatment furnace in a heat treatment system and which is separated as an airtight region, said method comprising the steps of:

purifying and sending said cooling fluid to the vicinity of said throat of said heat treatment furnace;

sucking said cooling fluid, which is sent to the vicinity of said throat, over a heat exchanger, which is arranged in the vicinity of said throat, by means of an intake fan to draw said cooling fluid into a duct which is formed as a circulating path for returning said cooling fluid;

sucking said cooling fluid, which is sent by said ventilating unit, at a different position from a position at which said cooling fluid is sucked by said intake fan, by means of an intake port which is formed on said duct; and

cooling said cooling fluid, which is drawn into said duct from said intake fan and said intake port to join, by means of a second heat exchanger, which is arranged in said duct downstream of said intake port, to return the cooled cooling fluid to said ventilating unit,

wherein said steps are continuously carried out in a process for carrying said object out of at least said throat of said heat treatment furnace.

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